BUILDING INVENTORY AND ENERGY USE SURVEY 1984

Mackenzie Valley Communities

Energy, Mines and Resources Canada

Energie, Mines et Ressources Canada

Canada

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Remote Community Demonstration Program

Energy, Mines and Resources Canada

1984

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The opinions and recommendations in this report are those of the consultant and not necessarily of Energy, Mines and Resources Canada.

EXECUTIVE SUMMARY

The 1984 Building Inventory and Energy Use Survey (BIEUS) is a follow-on from the 1982 and 1983 exercises. Collectively, the data and recommendations refer to the Mackenzie River communities up to the treeline.

The major recommendation of the 1984 study parallels that of the 1983 exercise:

-that a more aggressive use of the renewable wood energy around communities is feasible and desirable from both an energy dollar saving and a socio-economic development point of view.

The first steps that could give meaning to this major recommendation are as follows:

1. that for all rental/leased buildings, a gradually phased-in user-pay to-market pricing scheme should prevail to encourage each building user to find his/her lowest cost space heating fuel source.

2. that proper firewood harvesting (consisting of cutting and drying cycles) and land use management plans be created for each community south of the treeline.

The potential benefits of the steps above are:

-a considerable annual dollar savings in space heating costs ranging upward to estimated maximums of $7.8 to 17.4 million with full conversion from fuel oil to wood.

-an increased degree of community self-sufficiency based on a local resource and labour.

-opportunities for community employment and local business to provide fuel wood management and product-handling services.

This 1984 Survey Study was done under the Remote Community Demonstration Program of Energy, Mines and Resources Canada.

INVENTAIRE DES IMMEUBLES ET EXAMEN DE LEUR CONSOMMATION D'ENERGIE, 1984

Collectivités près du sud du fleuve Mackenzie (T. N.-O.)

Résumé

L'inventaire des immeubles et l'examen de leur consommation d'énergie de la présente année donne suite à ceux de 1982 et 1983. L'ensemble des données et recommandations porte sur les collectivités situées près du fleuve Mackenzie, jusqu'à la limite forestière.

La principale recommandation de l'examen de 1984 demeure la même que celle de 1983, c'est-à-dire qu'il est faisable et souhaitable d'utiliser plus couramment le bois dans les collectivités, tant du point de vue des économies d'argent que du développement socio-économique.

Les premiers pas à faire dans le but d'arriver à cette recommandation sont les suivants:

- amener graduellement tous les utilisateurs qui demeurent dans des immeubles loués à payer le prix du marché, afin de les encourager à trouver des sources d'énergie plus rentables;

- élaborer des plans adéquats de récolte du bois de chauffage (constitués des cycles de la coupe et du séchage) et de gestion de l'utilisation des terres relativement à chacune des collectivités située au sud de la limite forestière.

Les avantages potentiels reliés aux étapes susmentionnées sont les suivants:

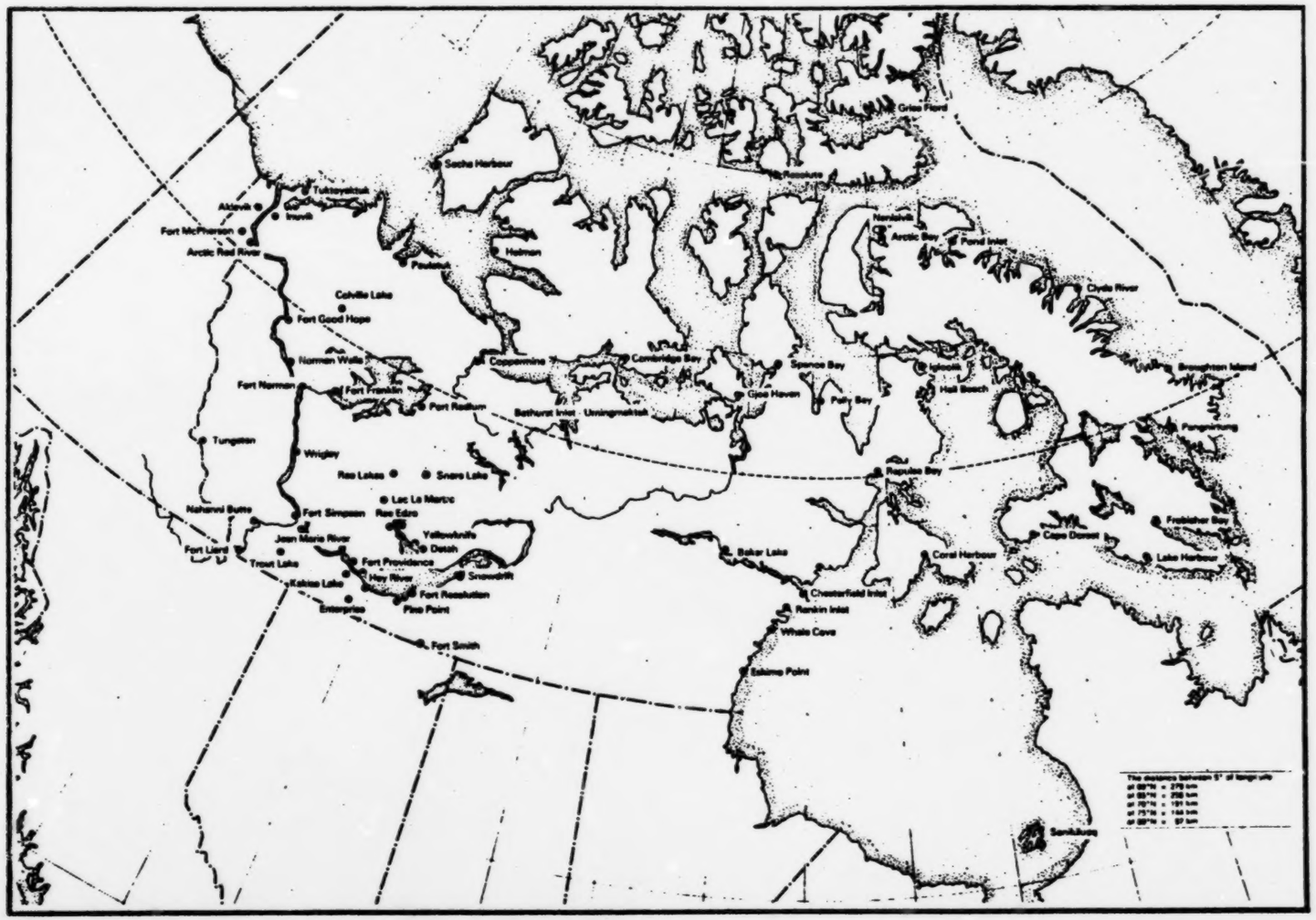
- réalisation annuelle d'économies d'argent considérables en ce qui a trait aux coûts de chauffage. Les estimations stipulent que des économies maximales de 7,8 millions à 17,4 millions de dollars pourraient être faites si une conversion complète des systèmes au mazout au bois était effectuée;

- accroissement du degré d'autosuffisance pour la collectivité étant donné qu'elle s'approvisionnerait à même des ressources et de la main d'oeuvre de la région;

- possibilités de création d'emplois et occasions pour les entreprises locales d'assurer la gestion du bois de chauffage et la manutention des produits.

L'étude de 1984 a été effectuée par Treeline Planning Services Ltd. de Yellowknife sous les auspices du Programme de démonstration dans les collectivités éloignées d'Energie, Mines et Ressources Canada.

Communities of the NWT



ACKNOWLEDGEMENT

We wish to acknowledge the co-operation of the following groups of people in the compilation of this Report: the various oil, wood and propane dealers; P.O.L. Division of the Government of the Northwest Territories; local settlement authorities; City of Yellowknife Works Department; private homeowners and woodburners surveyed by telephone.

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CHAPTER 1- INTRODUCTION AND BACKGROUND

The Federal Department of Energy, Mines and Resources (E.M.R.), through the Conservation and Renewable Energy Offices and the Remote Community Demonstration Program, have been seeking ways and means of reducing Canada's dependence on oil.

This Building Inventory and Energy Use Summary Study (BIEUS) for 1984 was instituted as a follow-on to the BIEUS'82 (South Slave Area) and BIEUS'83 study (Lower Mackenzie Area). The intent of this year's exercise was to merge the data of the two previous years and complete it with additional estimates for the South Slave and Yellowknife areas. The final product was conceived as an overview picture of space heating energy use for the South of Treeline communities. It was hoped that the summary document could be used as a planning tool for future energy policy creation in the treed area of the Western Arctic.

Given the major thrust of EMR to reduce dependence on oil and promote energy self-sufficiency, this study attempts to develop a better appreciation of the current and potential use of wood as a solid fuel source amongst other energy options.

The research background to this report has required a great deal of estimation because of the inherent difficulties in measuring wood volumes as a solid fuel, and because of the frontier tendency to informal back-of-the-envelope record-keeping. Research was conducted by telephone interview in an effort to keep costs down to a minimum. In contrast to this, electrical and liquid hydrocarbon uses are 'meterable' with centralized, mature distribution networks having good quality record-keeping. Oil dealers were periodically reluctant to reveal their business volumes when they had felt some market loss in a shrinking or a static market. The breakdown of product totals in distribution to various communities required some assumptions and calculation.

This study is composed of three distinct par[illegible]d as follows:

Part A- Renewable and non-renewable fuel estimates for the nineteen communities of the South Mackenzie - See Chapter 2

Part B- Merging of the 1982 and 1983 Building Inventory and Energy Use data sets to form a "South of the Treeline" data base for the twenty-nine communities of the Mackenzie area (except Yellowknife) - See Chapter 3

Part C- City of Yellowknife Renewable and Non-renewable fuel use estimates- See Chapter 4

CHAPTER 2- PART A- TABLES 1 TO 7

Overview:

Table 1 presents an overview of the estimated amount, type and value of renewable (wood) and non-renewable (oil, propane) fuels used in the nineteen Part A Mackenzie communities. It is a composite table made up of information gathered on three different types of energy supply.

Illustration 1 demonstrates in graphic form the percentage breakdown in commercial fuel values by type. Fuel oil is by far the most predominant fuel in the South Mackenzie communities.

Renewable Wood:

Table 2 models the wood stocks potentially available by community of the South Mackenzie. Various assumptions have been made in order to calculate the volumes required and the theoretical maximum distance from the center of a given community that one would have to travel in order to acquire fuel wood. Greater articulation of the forest yield assumption (expressed in cords per acre) could yield more precise results. Research by telephone enquiry indicated that most individuals in the smaller communities burned an average of 12 cords per season.

In less theoretical terms, discussions with professional foresters have revealed that there is effectively an 'unlimited' supply of fuel wood around all communities in the study area IF the resource were to be exploited in a planned, organized way (i.e.: harvested green, split and dried for one year before burning). Table 2 figures on harvesting areas are predicated on this "good management" assumption.

TABLE 1

ESTIMATED AMOUNT, TYPE, AND COST OF FUELS BY COMMUNITY

COMMUNITY	WOOD @ QTY. CORDS	WOOD** $/CORD	WOOD VALUE $$$	PROPANE LITRES	PROPANE $/LITRE	PROPANE $$$	OIL QTY. LITRES	OIL PRICE $/LITRE	OIL VALUE $$$	TOTAL VALUE
DETAH	252	NA	0	0		0	232287	.396	91986	91986
EDZO	12	75.00	900	21739	.3245	7054	1045415	.433	452665	460619
ENTERPRISE	48	NA	0	43478	.294	12783	79550	.383	30468	43250
FORT LIARD	756	NA	0	0	0	0	730157	.52	379682	379682
FORT PROVIDENCE	96	62.50	6000	10870	.294	3196	700000	.428	299600	308796
FORT RAE	120	75.00	9000	16304	.3245	5291	2104493	.433	911245	925536
FORT RESOLUTION	456	5.00	2280	27174	.294	7989	1033300	.383	395754	406023
FORT SIMPSON	516	60.00	30960	119565	.294	35152	1227444	.389	477476	543588
FORT SMITH	2436	65.00	158340	86956	.294	25565	CD	CD	2000000	2183905
HAY RIVER VILLAGE	444	35.00	15540	0	0	0	30000	.383	11490	27030
JEAN-MARIE RIVER	192	NA	0	5435	.294	1598	86626	.56	48511	50108
KAKISA	84	62.50	5250	0	0	0	0	0	0	5250
LAC LA MARTRE	372	35.00	13020	0	0	0	507078	.6	304247	317267
MAHANNI BUTTE	144	NA	0	0	0	0	147625	.53	78241	78241
PINE POINT	0	NA	0	43478	.294	12783	CD	CD	1234447	1247230
RAE LAKES	444	NA	0	0	0	0	215775	.64	138096	138096
SNOWDRIFT	240	NA	0	0	0	0	672896	.47	316261	316261
TROUT LAKE	228	NA	0	0	0	0	41000	.73	29930	29930
WRIGLEY	324	NA	0	0	0	0	476271	.47	223847	223847
TOTAL	7164		241290	374999		111410	9329917		7423945	7776645
AVERAGE		52.77								
% OF ALL FUEL VALUE			3.10			1.43			95.46	

@ - ESTIMATED BY ASSUMING 12 CORDS/ UNIT ON THE NUMBER OF WOODBURNING UNITS IN BIEUS'82
** - 'NA' SHOWN WHERE WOODBURNERS CUT OWN SUPPLY
** - IF ALL 'NA' COMMUNITIES VALUED WOOD AT $35/CORD, THEN TOTAL WOOD VALUE WOULD BE $ 331590
** - TOTAL VALUE FOR ALL FUELS WOULD RISE TO $ 7866945.
CD - CONFIDENTIAL

ILLUSTRATION 1: Percentage of Commercial Fuel Value by Type - South Mackenzie

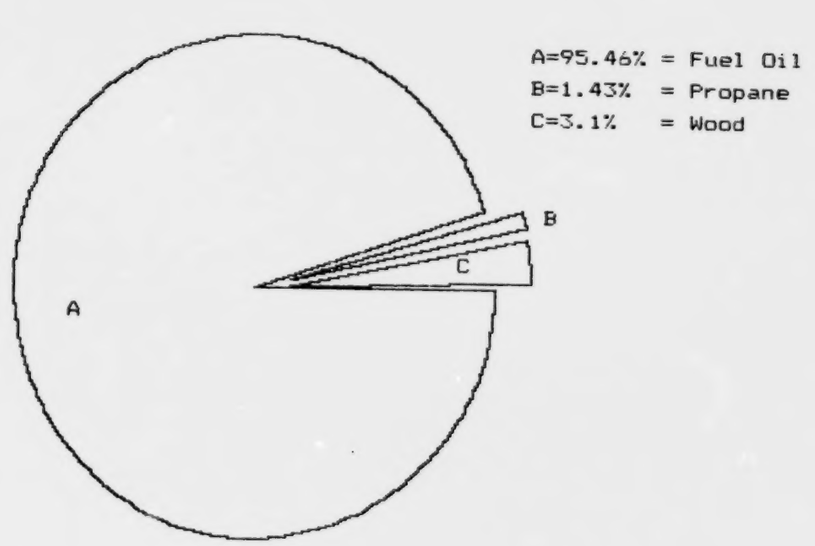


TABLE 2

ESTIMATED WOOD STOCKS BY COMMUNITY

(SEE ASSUMPTIONS BELOW)

COMMUNITY	NUMBER OF BUILDINGS	TOTAL CORDS	TOTAL $VALUE	ACRES PER YEAR	LIFECYCLE ACRES	LIFECYCLE SQ.MILES	RADIUS MILES
DETAH	35	420	22163.40	34.24	4280	7	1.46
EDZO	76	912	48126.24	74.36	9295	15	2.15
ENTERPRISE	23	276	14564.52	22.50	2813	4	1.18
FORT LIARD	108	1296	68389.92	105.67	13208	21	2.56
FORT PROVIDENCE	132	1584	83587.68	129.15	16143	25	2.83
FORT RAE	153	1836	96885.72	149.69	18712	29	3.05
FORT RESOLUTION	126	1512	79788.24	123.28	15410	24	2.77
FORT SIMPSON	272	3264	172241.28	266.12	33265	52	4.07
FORT SMITH	687	8244	435035.88	672.16	84020	131	6.46
HAY RIVER VILLAGE	43	516	27229.32	42.07	5259	8	1.62
JEAN MARIE RIVER	22	264	13931.28	21.52	2691	4	1.16
KAKISA	7	84	4432.68	6.85	856	1	.65
LAC LA MARTRE	50	600	31662.00	48.92	6115	10	1.74
NAHANNI BUTTE	34	408	21530.16	33.27	4158	6	1.44
PINE POINT	498	5976	315353.52	487.24	60905	95	5.50
RAE LAKES	45	540	28495.80	44.03	5503	9	1.65
SNOWDRIFT	55	660	34828.20	53.81	6726	11	1.83
TROUT LAKE	20	240	12664.80	19.57	2446	4	1.10
WRIGLEY	61	732	38627.64	59.68	7460	12	1.93
TOTAL	2447	29364	1549538.28	2394.13	299266	468	

ASSUMPTIONS:
ALL COMMUNITY BUILDINGS BURN WOOD FOR SPACE HEATING
ANN.CONSUMP'N PER BUILDING= 12
RETAIL $ VALUE PER CORD= 52.77
FOREST LIFECYCLE YEARS= 125
FOREST YIELD(CORDS/ACRE)= 12.27 (AVERAGE OF OBSERVED FORT SMITH AND EDZO YIELDS)
ONE SQ.MILE= 640 ACRES

Table 3 estimates the number of permits for fuel wood harvesting volumes issued by the Territorial and Federal Governments for Part A communities. The figures represent only some portion of the actual wood harvested. It is suspected in some instances that the permitted figures may overstate the actual cutting because the permittee did not cut the quoted amount. There is minimal incentive for government to verify permitee areas and quantities for compliance with the permit when there is little competition for the resource. According to permit issuing bodies, non-native people with cultural experience of permits and licences tend to acquire permits before native people in similar situations. On the other hand, with land claims pending, many Native people are reluctant to apply for permits for domestic wood supply from land they feel is theirs by birthright. It is thought that there are many small domestic users that simply harvest without the formality of a permit from either level of government.

When communities are in close proximity (ex: Rae-Edzo), it is difficult to know with certainty where the harvested wood would eventually be utilized; and the location of a permitted area can be vague (often a red line on a map). Government officials contacted on this issue felt that the scope and volume of a proposed cutting area would very much dictate the attention that would be given to the issuance of a permit.

Table 4 presents gathered data on wood dealers and their estimated volumes of business by community. The telephone survey to communities revealed that wood dealers are a constantly changing group, with individuals taking on the activity and dropping it later in favour of more profitable activites.

An interesting facet of the investigation turned up the suggestion that Social Services of the Territorial Government was paying to have wood fuel delivered to the elderly in some of the small communities. A more formal check with Government at a higher level revealed that no official policy in this regard existed, and that any government payment for firewood delivery to needy cases was done at the discretion of local social welfare officers.

TABLE 3

NUMBER OF FUEL-WOOD HARVESTING PERMITS ISSUED & ESTIMATED VOLUMES BY GOVERNMENT

COMMUNITY	GNWT* #PERMITS	GNWT VOLUMES	FEDERAL #PERMITS	FEDERAL VOLUMES	COMBINED #PERMITS	COMBINED VOLUMES
DETAH	0	0	0	0	0	0
EDZO	0	0	.5@	250	.5	250
ENTERPRISE	0	0	0	0	0	0
FORT LIARD	0	0	3	20	3	20
FORT PROVIDENCE	0	0	1	275	1	275
FORT RAE	0	0	.5@	250	.5	250
FORT RESOLUTION**	0	0	0	0	0	0
FORT SIMPSON	0	0	25	625	25	625
FORT SMITH	0	0	111	6000	111	6000
HAY RIVER VILLAGE	0	0	0	0	0	0
JEAN-MARIE RIVER	0	0	0	0	0	0
KAKISA	0	0	0	0	0	0
LAC LA MARTRE	0	0	0	0	0	0
MAHANNI BUTTE	0	0	0	0	0	0
PINE POINT	0	0	0	0	0	0
RAE LAKES	0	0	0	0	0	0
SNOWDRIFT	0	0	0	0	0	0
TROUT LAKE	0	0	0	0	0	0
WRIGLEY	0	0	0	0	0	0
TOTAL	0	0	141	7420	141	7420

* - GNWT HAS LAND MANAGEMENT JURISDICTION IN SOME OF THE FOLLOWING COMMUNITIES
@ - SHARED PERMIT - RAE/EDZO DENE BAND
** - SAW MILL PROVIDES SCRAPS TO DOMESTIC USERS FOR NOMINAL FEE

TABLE 4

WOOD DEALERS & VOLUMES (ESTIMATED)

COMMUNITY	NUMBER OF WOOD DEALERS	BIEUS'82 W-BURN'G UNITS #'S	DEALERS' VOLUME IN CORDS*
DETAH	NONE	21	0
EDZO	1	1	6
ENTERPRISE	NONE	4	0
FORT LIARD	NONE	63	0
FORT PROVIDENCE	2	8	48
FORT RAE	1	10	60
FORT RESOLUTION	1	38	228
FORT SIMPSON	1	43	258
FORT SMITH	3	203	1218
HAY RIVER VILLAGE @	NONE	37	0
JEAN-MARIE RIVER	NONE	16	0
KAKISA	NONE	7	0
LAC LA MARTRE	NONE	31	0
NAHANNI BUTTE	NONE	12	0
PINE POINT	NONE	0	0
RAE LAKES	NONE	37	0
SNOWDRIFT	NONE	20	0
TROUT LAKE	NONE	19	0
WRIGLEY	NONE	27	0
TOTAL	9	597	1818

* - ASSUMED AT 6 CORDS/WOOD-BURNING BUILDING UNIT IN THE BIEUS'82 STUDY
@ - BAND COUNCIL CUTS AND DELIVERS WOOD

Table 5 presents estimated wood volumes for privately harvested wood. Private Harvesters are defined as the number of wood-burning units appearing in the 1982 BIEUS report by community (Some of these appear to understate the actual numbers (ex: Fort Rae with 10 wood-burning units?)) . A further assumption is made that wood-burning units would use 12 cords a year, and that where a wood dealer was present, wood-burners would purchase 6 cords from the dealer and harvest the remaining 6 cords themselves. Where no dealer was present, it was assumed that the wood-burners would harvest the full 12 cords themselves.

Non-renewable Fuels:

Table 6 presents estimates of the amount and value of fuel oil used for space heating by community. It also presents information on the number of fuel oil dealers and whether these suppliers are in the private or public (GNWT Petroleum, Oil, and Lubricants Division) sector. At the request of some of the private oil dealers serving a single community, confidentiality in their individual estimate is preserved by deleting their volumes and value figures and summing community figures so as to alay their concerns. It should be noted, however, that the bottom-line totals reflect the full estimate figures given by the dealers collectively.

Table 7 presents amounts, storage capacity, and delivery mode for non-renewable fuels by community.

Tables 6 and 7 information is backround to Table 1 of Part A of this report.

TABLE 5

PRIVATELY HARVESTED WOOD VOLUMES (ESTIMATED)

COMMUNITY	BIEUS'82 W-BURN'G UNIT #'S**	NUMBER OF PRIVATE@ HARVESTERS	PRIV'LY CUT CORDS PER UNIT	HARVESTER VOLUME IN CORDS*
DETAH	21	21	12	252
EDZO	1	1	6	6
ENTERPRISE	4	4	12	48
FORT LIARD	63	63	12	756
FORT PROVIDENCE	8	8	6	48
FORT RAE	10	10	6	60
FORT RESOLUTION	38	38	6	228
FORT SIMPSON	43	43	6	258
FORT SMITH	203	203	6	1218
HAY RIVER VILLAGE	37	37	12	444
JEAN-MARIE RIVER	16	16	12	192
KAKISA	7	7	12	84
LAC LA MARTRE	31	31	12	372
NAHANNI BUTTE	12	12	12	144
PINE POINT	0	0	12	0
RAE LAKES	37	37	12	444
SNOWDRIFT	20	20	12	240
TROUT LAKE	19	19	12	228
WRIGLEY	27	27	12	324
TOTAL	597	597		5346

@ - ASSUMED AT NUMBER OF WOOD-BURNING UNITS IN THE BIEUS'82 STUDY

* - ASSUMED AT 6 CORDS/WOOD-BURNING BUILDING UNIT
EXCEPT WHERE NO COMMERCIAL DEALER
OTHERWISE ASSUMED AT 12 CORDS/WOOD-BURNING UNIT

** - SOURCE: 1982 BIEUS STUDY

TABLE 6

AMOUNT AND VALUE OF FUEL OIL USED FOR HEATING (ESTIMATED) BY COMMUNITY

COMMUNITY	DEALERS SERVING COMMUNITY	DEALER SECTOR *	VOLUME OF FUEL OIL IN LITRES	$/LITRE	$VALUE
DETAH	2	P	232287	.396	91986
EDZO	2	P	1045415	.433	452665
ENTERPRISE	2	P	79550	.383	30468
FORT LIARD	1	G	730157	.52	379682
FORT PROVIDENCE	2	P	700000	.428	299600
FORT RAE	2	P	2104493	.433	911245
FORT RESOLUTION	2	P	1033300	.383	395754
FORT SIMPSON	1	P	1227444	.389	477476
FORT SMITH	1	P	CO	CO	2000000
HAY RIVER VILLAGE	1	P	30000	.383	11490
JEAN-MARIE RIVER	1	G	86626	.56	48511
KAKISA	0	N.A.	0	N.A.	0
LAC LA MARTRE	1	G	507078	.6	304247
NAHANNI BUTTE	1	G	147625	.53	78241
PINE POINT	5	P	CO	CO	1234447
RAE LAKES	1	G	215775	.64	138096
SNOWDRIFT	1	G	672896	.47	316261
TROUT LAKE	1	G	41000	.73	29930
WRIGLEY	1	G	476271	.47	223847
TOTAL			17553017		7423945

* - P=PRIVATE; G=GOVERNMENT

N.A.= NOT AVAILABLE
CO=CONFIDENTIAL

TABLE 7

AMOUNT USED, STORAGE CAPACITY, DELIVERY MODE FOR NON-RENEWABLE FUEL BY COMMUNITY

COMMUNITY	AMOUNT OF FUEL OIL IN LITRES	AMOUNT OF PROPANE IN LITRES	STORAGE CAP. PROPANE IN LITRES	STORAGE CAP. FUEL OIL IN LITRES	DELIVERY MODE FUEL OIL	DELIVERY MODE PROPANE
DETAH	232287	0	0	0	ROAD	ROAD
EDZO	1045415	21739	0	0	ROAD	ROAD
ENTERPRISE	79550	43478	0	0	ROAD	ROAD
FORT LIARD	730157	0	0	499152	ROAD	ROAD
FORT PROVIDENCE	700000	10870	0		ROAD	ROAD
FORT RAE	2104493	16304	0	0	ROAD	ROAD
FORT RESOLUTION	1033300	27174	0	0	ROAD	ROAD
FORT SIMPSON	1227444	119565	0		ROAD	ROAD
FORT SMITH	CO	86956	0	272765	ROAD	ROAD
HAY RIVER VILLAGE	30000	0	0	0	ROAD	ROAD
JEAN-MARIE RIVER	86626	5435	0	230867	BARGE	BARGE
KAKISA	0	0	0	0	ROAD	ROAD
LAC LA MARTRE	507078	0	0	1054338	W.R.	N.A.
NAHANNI BUTTE	147625	0	0	127516	W.R.	N.A.
PINE POINT	CO	43478	0		RAIL	ROAD
RAE LAKES	215775	0	0	187266	W.R.	N.A.
SNOWDRIFT	672896	0	0	693050	BARGE	N.A.
TROUT LAKE	41000	0	0	23489	AIR	N.A.
WRIGLEY	476271	0	0	469555	BARGE	N.A.
TOTAL	17553017	374999				

W.R. = WINTER ROAD
N.A. = NOT AVAILABLE
CO=CONFIDENTIAL

CHAPTER 3- PART B- TABLES 8 & 9

Chapter 3 contains consolidated tables of Ownership and fuel type by community, for all communities of the Upper and Lower Mackenzie areas. Information gathered in the 1982 and 1983 Building inventory and Energy use Studies (BIEUS) were placed on a computerized database with a Northern computer time-sharing firm. See Appendix A for a copy of the field survey form utilized during the data gathering years. Each year's database was created independently, but in an identical format. This allowed the merging of the two databases in 1984, into a comprehensive 5450 record database for the South-of-Treeline communities of the Mackenzie area (Yellowknife excepted).

Table 8, titled Community Building Units by Ownership and Ownership Grouping, lays out the number of buildings observed in the 29 communities over the two years of BIEUS field research. The ownership catagories are grouped into broader categories for government, business and privately-held ;and each are expressed as percentages of total community stock. A basic thesis of this study is that ownership of a building and its consequent management largely determine the type (and influence the quantity) of energy used.

Table 8 shows that nearly half of the buildings of the study communities are owned directly by the government (including Social and Staff housing, plus operational buildings). Amongst these communities, government ownership of buildings averaged a little less than half of all buildings (41.72%), but could rise as high as the 90%-plus region (Edzo, Hay River Reserve, Fort Providence). See Illustration 2 for a graphic view of building ownership. In contrast to this, business-owned buildings averaged a little less (22.70%) than one quarter of all structures. Privately-held building stock represents roughly one third (35.58%) of the total building stock, although this could range, by community, from a low of approximately 2% (Hay River Reserve) to a high of 100% in Kakisa. More detailed research would have to be done to determine the portion of these privately-held units that are actually occupied by their owners.

TABLE B

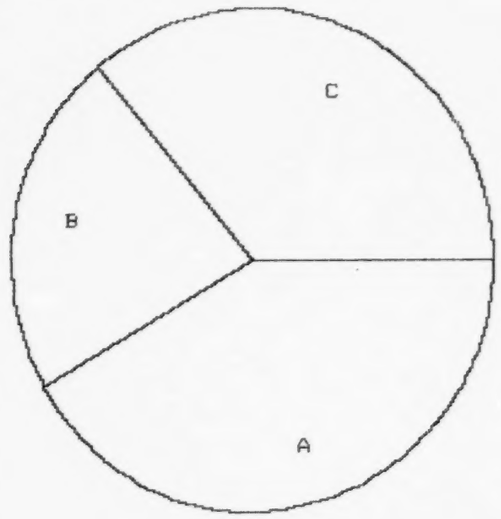
COMMUNITY BUILDING UNITS BY OWNERSHIP AND OWNERSHIP GROUPING

COMMUNITY NUMBER	COMMUNITY NAME	NWTHC A	TERR. B	FEDERAL C	CROWN CORPS D	COMMUNITY G	GOVERNMENT PERCENTAGE	INDUSTRY E	COMMERCIAL F	BUSINESS PERCENTAGE	PRIVATE H	PRIVATE PERCENTAGE	TO NUM
400	INUVIK	76	99	134	22	16	46.27	0	228	30.40	175	23.33	
401	AKLAVIK	133	28	6	12	8	75.10	0	17	6.83	45	18.07	
402	FT.MCPHERSON	62	42	7	10	6	57.21	0	12	5.41	83	37.39	
403	ARCTIC RED RIVER	18	13	1	4	0	67.92	0	5	9.43	12	22.64	
304	COLVILLE LAKE	0	0	1	1	0	5.41	0	17	45.95	18	48.65	
302	FT. GOOD HOPE	28	34	6	12	2	48.52	0	15	8.88	72	42.60	
301	FORT NORMAN	41	23	5	5	4	60.47	0	15	11.63	36	27.91	
303	FORT FRANKLIN	67	22	2	11	1	73.05	0	16	11.35	22	15.60	
300	NORMAN WELLS	16	28	46	13	4	34.41	0	177	56.91	27	8.68	
109	HAY RIVER	42	62	68	96	41	33.01	0	208	22.22	419	44.76	
100	FORT SMITH	5	102	83	1	20	30.62	0	22	3.19	456	66.18	
101	FORT RESOLUTION	41	3	9	0	6	46.83	0	9	7.14	58	46.03	
103	SNOWDRIFT	20	8	3	0	3	61.82	0	1	1.82	20	36.36	
104	DETAH	0	6	1	0	2	25.71	0	1	2.86	25	71.43	
106	FORT RAE	26	71	8	0	4	71.24	0	5	3.27	39	25.49	
107	ENTERPRISE	0	1	0	0	1	8.70	1	4	21.74	16	69.57	
108	PINE POINT	0	2	6	0	11	3.80	433	4	87.40	44	8.80	
110	FORT PROVIDENCE	97	11	4	0	6	89.39	0	5	3.79	9	6.82	
114	LAC LA MARTRE	4	3	7	0	3	34.00	0	2	4.00	31	62.00	
119	EDZO	0	71	0	0	2	96.05	0	0	.00	3	3.95	
120	RAE LAKES	0	2	3	0	3	17.78	0	0	.00	37	82.22	
136	H.R.INDIAN RESERVE	0	0	0	0	42	97.67	0	0	.00	1	2.33	
200	FORT SIMPSON	34	17	44	0	8	37.59	0	30	10.95	141	51.46	
201	JEAN MARIE RIVER	0	2	2	0	3	31.82	0	0	.00	15	68.18	
202	NAHANNI BUTTE	0	6	2	0	1	26.47	0	4	11.76	21	61.76	
203	FORT LIARD	14	8	10	3	9	40.74	0	5	4.63	59	54.63	
204	WRIGLEY	6	12	4	2	4	45.90	0	1	1.64	32	52.46	
206	TROUT LAKE	0	2	0	0	2	20.00	0	0	.00	16	80.00	
208	KAKISA	0	0	0	0	0	.00	0	0	.00	7	100.00	
	TOTAL	730	678	462	192	212	41.72	434	803	22.70	1939	35.58	5

NWTHC = NORTHWEST TERRITORIES HOUSING CORPORATION
TERR. = TERRITORIAL DEPT. OF PUBLIC WORKS
FEDERAL = FEDERAL DEPT. OF PUBLIC WORKS
COMMUNITY= MUNICIPAL GOVERNMENT

ILLUSTRATION 2

Government, Business,and Private Building Ownership -
Mackenzie Region



A=41.72% = GOVERNMENT
B=22.7% = BUSINESS
C=35.58% = PRIVATE

Table 9 is a consolidated (for all BIEUS'82 and BIEUS'83 communities) table of Ownership by Fuel Type, also arranged in ownership groupings. This table demonstrates the pronounced use of fuel oil (3397 or 62.3% of a total of 5450 units) among the various space heating alternatives. Of these oil-heated buildings, roughly half (48.25%) are government owned and controlled, a quarter (25.76%) are business owned, and a quarter (25.99%) are privately owned. See Illustration 2A for a graphic view of the percentage of oil-burning units by Ownership breakdown.

On the other hand, there would seem to be a distinct tendency for privately owned buildings to be heated with alternative fuels. This is supported by Table 9 statistics showing that 84.03% of all wood-heated buildings are privately owned, 2.84% are business owned and 13.13% are government owned. The percentage breakdown of wood-burning units by Ownership Grouping is shown in Illustration 2B.

These figures would support the notion that those who are more directly accountable for their own energy use will tend to seek the lower cost energy type available.

TABLE 9

ALL COMMUNITIES BUILDINGS BY OWNERSHIP AND FUEL TYPE

FUEL TYPE / LETTER DESIGNATION	OIL A	ELECTRIC B	WOOD C	PROPANE D	NAT.GAS E	ELEC.& OIL F	ELEC.&PROP F-1	ELEC.& WOOD G	OIL & PROPANE	OIL & WOOD H	WOOD & PROPANE	UTILIDOR & WOOD	NAT.GAS & WOOD	OIL & NAT.GAS	UNHEATED I	UTILIDOR I	TOTAL
BUILDING OWNERSHIP																	
N.W.T.HOUSING CORP.-A	633	0	28	0	4	0	0	0	0	2	0	0	0	0	7	56	730
TERRITORIAL GOV'T-B	508	1	14	8	24	0	0	0	1	9	0	0	0	0	48	65	678
FEDERAL GOV'T-C	275	1	10	3	35	0	0	0	1	10	0	0	0	0	15	112	462
CROWN CORPORATIONS-D	119	0	1	28	10	0	0	0	0	6	0	0	0	0	18	10	192
COMMUNITY-G	104	2	44	8	3	0	0	0	3	5	30	0	0	0	8	5	212
SUB-TOTAL GOV'T	1639	4	97	47	76	0	0	0	5	32	30	0	0	0	96	248	2274
PERCENTAGE GOV'T	48.25	21.05	13.13	22.17	37.44	.00	.00	.00	35.71	12.85	76.92	.00	.00	.00	51.06	67.76	41.72
INDUSTRIAL-E	434	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	434
COMMERCIAL-F	441	7	21	54	120	0	0	1	2	23	1	0	4	1	55	73	803
SUB-TOTAL BUSINESS	875	7	21	54	120	0	0	1	2	23	1	0	4	1	55	73	1237
PERCENTAGE BUSINESS	25.76	36.84	2.84	25.47	59.11	.00	.00	7.69	14.29	9.24	2.56	.00	100.00	100.00	29.26	19.95	22.70
PRIVATE-H	883	8	621	111	7	2	1	12	7	194	8	3	0	0	37	45	1939
PERCENTAGE PRIVATE	25.99	42.11	84.03	52.36	3.45	100.00	100.00	92.31	50.00	77.91	20.51	100.00	.00	.00	19.68	12.30	35.58
TOTAL	3397	19	739	212	203	2	1	13	14	249	39	3	4	1	188	366	5450
% OF ALL UNITS	62.33	.35	13.56	3.89	3.72	.04	.02	.24	.26	4.57	.72	.06	.07	.02	3.45	6.72	100.00

ILLUSTRATION 2A

Percentage of Oil-burning Units by Ownership Grouping - Mackenzie Region

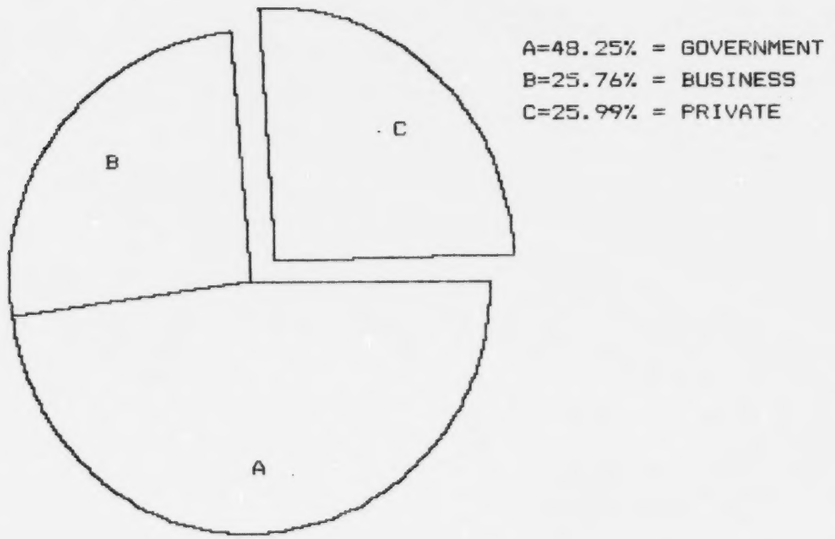
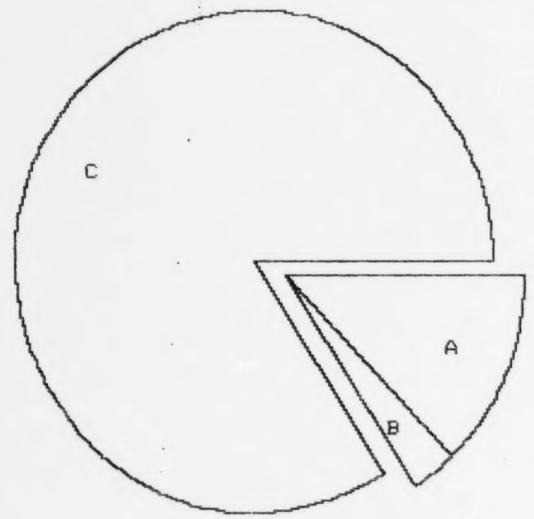


ILLUSTRATION 2B

Percentage of Wood-burning Units by Ownership Grouping - Mackenzie Region



A=13.13% = GOVERNMENT
B=2.84% = BUSINESS
C=84.03% = PRIVATE

CHAPTER 4- PART C- TABLES 10 TO 16

This part deals with the City of Yellowknife energy use. Appendix A field information has not yet been gathered.

WOOD

In order to estimate the degree of wood energy in use, City Hall was contacted to learn how many wood-burning appliance permits have been issued.

Table 10 shows that a total of 342 wood-burning appliance permits were issued over the three-year period 1982 to 1984. In contacting many of these by telephone, it was revealed that some of the 1984 appliances were only recently installed, and their new owners had little idea of annual consumption figures.

Table 11 contains the results of successful interviews with 38 permittees who felt they had some valid information to contribute. While the average price was $67.86 a cord; it is felt that many of the $25 a cord figures were artificially low because this price did not represent the very real cost of transport from the likely source near Rae-Edzo, some 100 kilometers from Yellowknife. This sample of Yellowknifers burned a seasonal average of 6.16 cords.

The estimated volume of word use in Yellowknife would be 3080 cords, if one assumed the total number of users to be 500 in number, each using an average of 6.16 cords per heating season. With a value of $67.86 a cord , this annual volume would have a value of $209,009.

Table 12 presents the results of interviews with four current wood fuel dealers in Yellowknife who are estimating a total market of 1245 cords for a total value of $125,000.

Table 15 presents information on the number of fuel wood permits issued for the Yellowknife area. Comments on the accuracy of permit issue in Chapter 1 also apply here.

TABLE 10

CITY OF YELLOWKNIFE WOOD-BURNING APPLIANCE PERMITS BY YEAR

YEAR	NUMBER OF PERMITS
1981	0*
1982	121
1983	125
1984	96**
TOTAL	342

* - WOOD-BURNING APPLIANCE FIGURES NOT IDENTIFIABLE FROM 1981 RECORDS AND EARLIER
** - TO 15/NOV ONLY

SOURCE: CITY OF YELLOWKNIFE BUILDING PERMITS DEPT.

TABLE 11

YELLOWKNIFE AMOUNT, PRICE AND SOURCE OF WOOD

PERMITTEE #	ANNUAL AMOUNT IN CORDS	$ PRICE PER CORD	* SOURCE
1	4	80	D
2	10	25	D/S
3	5	80	D
4	4	25	D/S
5	2.5	75	D
6	10	100	D
7	8	85	D
8	3	N.A.	S
9	3.5	25	D/S
10	4	N.A.	S
11	5	85	D
12	3	N.A.	S
13	10	N.A.	S
14	6	N.A.	S
15	10	N.A.	S
16	3	85	D/S
17	6	90	D/S
18	7	75	D
19	15	25	D/S
20	10	25	D/S
21	6	85	D
22	3	85	D
23	5	25	D/S
24	3	100	D
25	3	85	D
26	6	85	D/S
27	7	25	D/S
28	3	90	D/S
29	6	85	D/S
30	3	N.A.	S
31	6	85	D
32	2	N.A.	S
33	10	80	D
34	8	N.A.	S
35	10	N.A.	S
36	3	80	D
37	10	85	D
38	11	25	D/S
TOTAL	234		
AVERAGE	6.16	67.86	

* D=DEALER, S=SELF
N.A. = NOT AVAILABLE

TABLE 12

YELLOWKNIFE WOOD DEALERS' ESTIMATES OF MARKET VOLUME AND PRICES

DEALERS	AMOUNT IN CORDS	LOW PRICE $/CORD	HIGH PRICE $/CORD	AVERAGE $ PRICE/CD.	TOTAL $ VALUE
1	300	N.A.	120	120.00	36000
2	120	75	100	87.50	10500
3	350	85	110	97.50	34125
4	475	85	100	92.50	43938
TOTAL	1245				124563
AVERAGE		81.67	107.50		

N.A. = NOT AVAILABLE

TABLE 13

YELLOWKNIFE PROPANE USE ESTIMATE

# USERS	$/LITRE	AVERAGE CONSUMPTION IN LITRES	ESTIMATED $ VALUE	ESTIMATED VOLUME(LITRES)
278	.3245	3597	324500	1000000

TABLE 14

YELLOWKNIFE OIL DEALERS' ESTIMATES OF USERS, PRICE AND VOLUME

	# USERS	AVERAGE CONSUMPTION (LITRES)	$/LITRE	TOT$VALUE	ESTIMATED VOLUME IN LITRES
DEALER 1	450	35358	.395	6284969	15911313
DEALER 2	2000	10229	.396	8101132	20457404
TOTAL	2450	45587		14386101	36368717
AVERAGE			.3955		

TABLE 15

FUEL WOOD HARVESTING PERMITS ISSUED FOR YELLOWKNIFE

	# PERMITS	AVERAGE CORDAGE	TOTAL CORDAGE
FEDERAL	0	0	0
TERRITORIAL	2	5	10
TOTAL	2	5	10

PROPANE

Table 13 summarizes the results of an interview with the sole propane dealer in Yellowknife. Propane use in the city and surrounding area would appear to be at 1,000,000 litres with an estimated value of over $300,000.

FUEL OIL

In Table 14, fuel oil dealers indicate that a total of over 36 million litres of fuel are dispensed in an average year with a value of over 14 million dollars.

COMPARATIVE OVERVIEW

Table 16 draws together all the estimates for various fuel types and presents a breakdown by percentage of retail value by fuel type. As in the South Mackenzie, Yellowknife's fuel supply is largely provided by fuel oil (96.42%), with marginal use of propane (2.17%) and wood (1.40%). Illustration 3 shows the same information in graphic form.

TABLE 16

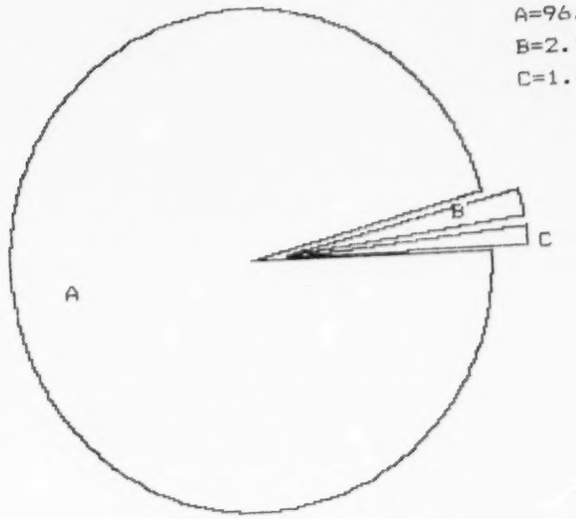
YELLOWKNIFE ESTIMATED QUANTITY AND VALUE BY FUEL TYPE

FUEL TYPE	QUANTITY	$ VALUE	VALUE %
FUEL OIL	36368717	14386101	96.42
PROPANE	1000000 L.	324500	2.17
WOOD	3080 CDS.	209009	1.40
TOTAL	N.A.	14919610	100.00

N.A. = NOT AVAILABLE

ILLUSTRATION 3

Percentage of Fuel Value by Type - Yellowknife



CHAPTER 5- CONCLUSIONS

1. Fuel Oil dominates the space heating fuel market with over 95 % of the total retail value of the Mackenzie Region of the Western Arctic. Propane and Wood are competing fuel types taking up a much smaller portion of the market.

2. For most of the communities of the Mackenzie, Government is the prime owner/landlord who generally prefers fuel oil to other fuel types. The exact proportion of buildings in Yellowknife owned and operated by Government is unknown, but it is generally known that Government is a major owner/landlord in the City.

3. Given the statements of Forestry officials concerning the vast supply potential of the treed portions of the Mackenzie River country (especially the South), it would seem that oil is probably being utilized largely for its convenience of use and its ease of acquisition (supplied by Government to offices, staff and social housing).

The above-mentioned convenience is resulting in needlessly high expenditures for space-heating energy in the Mackenzie Region of the Western Arctic, when these energy savings (especially for government) could be applied to programs of greater social need (ex.: housing or education).

The differential in price per unit of heat energy should logically lead policy makers to recommend the use of more locally harvested fuel. Table 17 presents Oil-based Estimated Wood Volumes, Values and Potential Savings for all Mackenzie Communitites.

TABLE 17 .

OIL-BASED ESTIMATED WOOD VOLUMES, VALUES, AND POTENTIAL SAVINGS FOR ALL MACKENZIE COMMUNITIES

COMMUNITY	VOLUME OF FUEL OIL IN LITRES	$/LITRE	$VALUE	EQUIVALENT WOOD VOLUME (CDS.)	& $$$VALUE	EQUIVALENT WOOD VOLUME (CDS.)	& $$$VALUE
AKLAVIK	1615844	.41	662496	6121	489650	3551	284104
INUVIK	5533483	.41	2268728	20960	1676813	12162	972920
FT. MCPHERSON	1290954	.41	529291	4890	391198	2837	226981
ARCTIC RED RIVER	149559	.46	68797	567	45321	329	26296
COLVILLE LAKE	4909	.71	3485	19	1488	11	863
FT. GOOD HOPE	1008955	.43	433851	3822	305744	2217	177399
NORMAN WELLS	0	.41	0	0	0	0	0
FT. FRANKLIN	1163120	.51	593191	4406	352461	2556	204505
FT. NORMAN	1392724	.43	598871	5275	422038	3061	244875
HAY RIVER	8907922	.41	3652248	33742	2699370	19578	1566228
YELLOWKNIFE	36368717	.3955	14383828	137760	11020823	79931	6394500
DETAH	232287	.396	91986	880	70390	511	40842
EDZO	1045415	.433	452665	3960	316792	2298	183809
ENTERPRISE	79550	.383	30468	301	24106	175	13987
FORT LIARD	730157	.52	379682	2766	221260	1605	128379
FORT PROVIDENCE	700000	.428	299600	2652	212121	1538	123077
FORT RAE	2104493	.433	911245	7972	637725	4625	370021
FORT RESOLUTION	1033300	.383	395754	3914	313121	2271	181679
FORT SIMPSON	1227444	.389	477476	4649	371953	2698	215814
FORT SMITH	CO	CO	2000000	18939	1515152	10989	879121
HAY RIVER VILLAGE	30000	.383	11490	114	9091	66	5275
JEAN-MARIE RIVER	86626	.56	48511	328	26250	190	15231
KAKISA	0	N.A.	0	0	0	0	0
LAC LA MARTRE	507078	.6	304247	1921	153660	1114	89157
WAHANNI BUTTE	147625	.53	78241	559	44735	324	25956
PINE POINT	CO	CO	1234447	12209	976697	7084	566699
RAE LAKES	215775	.64	138096	817	65386	474	37938
SNOWDRIFT	672896	.47	316261	2549	203908	1479	118311
TROUT LAKE	41000	.73	29930	155	12424	90	7209
WRIGLEY	476271	.47	223847	1804	144325	1047	83740
TOTAL	74989204		30618732	284050	22724001	164811	13184915
AVERAGE		.4660862					

ASSUMPTIONS:
- ONE CORD OF LOW DENSITY WOOD = 264 LITRES
& - VALUE OF WOOD = $80/CORD
@ - ONE CORD OF HIGH DENSITY WOOD = 455 LITRES
N.A.= NOT AVAILABLE
CO=CONFIDENTIAL

CONCLUSIONS:
SO SAVINGS USING LOW DENSITY WOOD=$ 7894731
AND SAVINGS USING HIGH DENSITY WOOD =$ 17433817

CHAPTER 6- GENERAL RECOMMENDATIONS

A. This report recommends that governments (including their agencies and corporations) should encourage the expanded use of wood renewable fuels in housing and operational buildings, by: a)immediately beginning the phasing in of close-to-market energy prices for fuel oil and tenant/staff accountability for actual energy used; and b) seriously considering the use of wood fuel in all new space heating applications.

B. It is recommended that more aggressive use of the abundant renewable energy wood sources around the communities be made by the proper management of wood stands (cutting, stacking and air drying an inventory for one season before use). This would probably best be managed through community-based land use management plans administered directly by the settlements with the support of GNWT Local Government's Community Planning and Lands Divisions or the Federal Lands Office, depending upon the existence and size of Block Land Transfer area around a given community.

C. It is recommended that those Departments of Government charged with Economic Development examine the feasibility of the creation of a Fuel Wood Industry for the communities of the Mackenzie River, and the job creation benefits that would flow from such activity.

CHAPTER 7- RECOMMENDATIONS TO COMMUNITIES

A. It is recommended that communities move gradually away from an extensive reliance on expensive, non-renewable petroleum based fuel oils to more readily available and cheaper sources of renewable wood energy.

The first means of reducing dependence on petroleum-based fuels in the Western Arctic should be the creation of a progressive energy accountability scheme (user-pay) at the building unit level. This would have the effect of giving the building occupant/manager the incentive to seek the lowest cost (consistent with the lifestyle or mission of the occupant) energy source for space heating.

With current low income levels and high energy prices, it is desireable that this should not happen overnight to dampen the inevitable social stresses that come with sudden change. Rather, fuel energy prices at the building unit level should gradually rise to closer to free market prices, and thereby giving an increasing incentive to the northern resident to use some amount of alternative (initially, but not exclusively wood) energy to lessen reliance upon expensive fuel oil.

Moves to using wood fuel in communities should be carefully coupled with public education in safe wood burning practices; and quickened fire fighting response time for chimney fires.

B. Given the current high levels of unemployment and welfare assistance, more N.W.T. communities South of the Treeline should consider the potential employment in wood fuel appliance maintenance (chimney sweeping), in planned wood fuel harvesting and handling, involved in the move to a renewable wood energy base.

C. Communities should request assistance in making detailed studies of their own energy budget , with a view to learning more about greater heating efficiency and community economic benefits through conversion to wood fuel.

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APPENDIX A

BUILDING INVENTORY AND ENERGY USE SURVEY

CODE # _____

A. 1. Region of community:
2. Name of community:

3. Location of building:

☐ a) address:
☐ b) lot #:

B. 4. Function:

☐ a) residential
☐ b) commercial
☐ c) community

C. 5. Ownership:

☐ a) N.W.T. Housing
☐ b) Government of the N.W.T.
☐ c) Public Works Canada
☐ d) Crown Corporations
- NCPC
- NTCL
- RCMP
- Canada Post
- N.W. Tel
- Other (specify) _____

☐ e) Industrial
- Cominco
- Giant
- Other (specify)

☐ f) Commercial
_____ (specify

☐ g) Community (specify)
_____

☐ h) Private

D. 6. Age of building:

☐ a) before Sept. 1977
☐ b) before Oct. 1980
☐ c) after Oct. 1980
☐ d) specify if possible _____

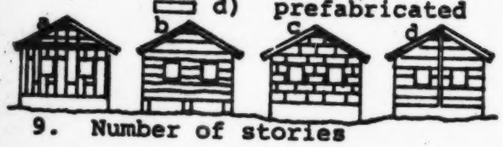
7. Type of building:

☐ a) single detached
☐ b) duplex
☐ c) multiple (up to four)
☐ d) row housing - # of units _____
☐ e) apartment complex - # of units _____
☐ f) highrise - # of units _____
☐ g) mobile home
☐ h) other (specify)
_____
_____

. . ./2

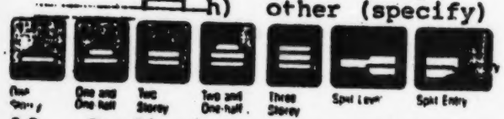
8. Type of construction:

- ☐ a) frame
- ☐ b) log
- ☐ c) masonary
- ☐ d) prefabricated



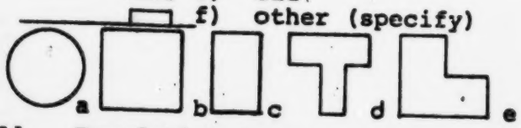
9. Number of stories

- ☐ a) one
- ☐ b) one and a half
- ☐ c) two
- ☐ d) two and a half
- ☐ e) three
- ☐ f) split-level
- ☐ g) split-entry
- ☐ h) other (specify) _____



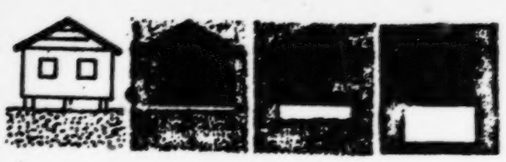
10. Configuration of building:

- ☐ a) round
- ☐ b) square
- ☐ c) rectangular
- ☐ d) tee
- ☐ e) ell
- ☐ f) other (specify) _____



11. Foundation type:

- ☐ a) Block/skid/pile
- ☐ b) slab on grade
- ☐ c) crawl space
- ☐ d) basement/cellar



a b c d

12. Perimeter

- ☐ a) less than 25m
- ☐ b) 26-30m
- ☐ c) 31-36m
- ☐ d) 37-42m
- ☐ e) 43-48m
- ☐ f) 49-56m
- ☐ g) 57-60m
- ☐ h) 61-65m
- ☐ i) more than 66 (specify)

_____

13. Number of windows

- ☐ a) specify _____

14. Number of doors

- ☐ a) specify _____

15. Eave height

- ☐ a) specify _____

16. Thickness of walls

- ☐ a) specify _____

17. Condition of structure

- ☐ a) good
- ☐ b) fair
- ☐ c) poor

18. Type(s) of fuel used for heating:

- ☐ a) oil
- ☐ b) electricity
- ☐ c) wood
- ☐ d) propane
- ☐ e) natural gas
- ☐ f) oil and electricity
- ☐ g) electricity and wood
- ☐ h) oil and wood
- ☐ i) other combinations (specify)

_____